What is claimed is:

1. A membrane electrode assembly (MEA) comprising:

a) a composite membrane having a first major surface area and a second major surface area comprising:

1) a membrane layer comprising an ionically conductive solid and an ionomeric binder;

2) at least one protective layer disposed adjacent to the membrane layer comprising an an ionically conductive solid and ionomeric binder, and optionally hygroscopic fine powder;

b) an anode comprising an oxidizing catalyst adjacent said first major surface area of said composite membrane;

c) a cathode comprising a reducing catalyst adjacent said second major surface area of said composite membrane.

2. The MEA of Claim 1 wherein the mebrane layer comprises a porous polymeric matrix.

3. The MEA of Claim 1 further comprising one or more collectors in contact with said anode and/or cathode.

4. The MEA of Claim 1 wherein the anode further comprises an ionomeric binder.

5. The MEA of Claim 4 wherein the anode further comprises an ionically conductive solid.

6. The MEA of Claim 6 wherein the ionomeric binder of the anode comprises a proton conducting ionomer.

7. The MEA of Claim 6 wherein the proton conducting ionomer of the anode is perfluorosulfonic acid.

8. The MEA of Claim 1 wherein the cathode further comprises an ionomeric binder.

9. The MEA of Claim 8 wherein the cathode further comprises an ionically conductive solid.

10. The MEA of Claim 4 wherein the ionomeric binder of the cathode comprises a proton conducting ionomer.

11. The MEA of Claim 10 wherein the proton conducting ionomer is perfluorosulfonic acid.

12. The MEA of Claim 1 wherein the ionomeric binder of the composite membrane is a proton conducting ionomer.

13. The MEA of Claim 12 wherein the proton conducting ionomer of the composite membrane is perfluorosulfonic acid.

14. The MEA of Claim 4 wherein the ionomeric binder content of the is between about 10% to about 100% of the anode catalyst content by volume.

15. The MEA of Claim 8 wherein the ionomeric binder content of the cathode is between about 10% to about 100% of the cathode catalyst content by volume.

16. The MEA of Claim 1 wherein the oxidizing catalyst of the anode is supported on carbon particles.

17. The MEA of Claim 16 wherein the percentage of catalyst in the anode that is supported on carbon is 20% to 60% by weight.

18. The MEA of Claim 16 wherein the catalyst loading of the cathode is between 0.05 and 5 $mg/cm^2$ frontal area.

19. The MEA of Claim 1 wherein the reducing catalyst of the cathode is supported on carbon particles.

20. The MEA of Claim 19 wherein the percentage of catalyst in the cathode that is supported on carbon is 20% to 60% by weight.

21. The MEA of Claim 19 wherein the catalyst loading of the cathode is between 0.05 and 5 $mg/cm^2$ frontal area.

22. The MEA of Claim 1 wherein the ionically conductive solid of the cathode is a heteropoly acid.

23. The MEA of Claim 22 wherein the heteropoly acid is selected from the group consisting of: phosphotungstic acid, phosphomolybdic acid, and zirconium hydrogen phosphate.

24. The MEA of Claim 5 wherein the ionically conductive solid of the anode is a heteropoly acid.

25. The MEA of Claim 24 wherein the heteropoly of the anode is selected from the group consisting of: phosphotungstic acid, phosphomolybdic acid, and zirconium hydrogen phosphate.

26. The MEA of Claim 9 wherein the ionically conductive solid of the cathode is a heteropoly acid.

27. The MEA of Claim 26 wherein the heteropoly acid of the cathode is selected from the group consisting of: phosphotungstic acid, phosphomolybdic acid, and zirconium hydrogen phosphate.

28. The MEA of Claim 9 wherein the ionically conductive solid of the cathode is between 20% and 40% of the content of the ionomer by volume.

29. The MEA of Claim 5 wherein the ionically conductive solid of the anode is between 20% and 40% of the content of the ionomer by volume.

30. The MEA of Claim 3 wherein the one or more collectors in contact with said anode and/or cathode consists of a porous material.

31. A fuel cell comprising the MEA of Claim 1.

32. An electrolysis cell comprising the MEA of Claim 1.

33. A vehicle comprising the fuel cell of Claim 30.

34. An electromechanical system comprising the electrolysis cell of Claim 32.

35. A process for fabricating a membrane electrode assembly (MEA) comprising:

a) obtaining a composite membrane having a first major surface area and a second major surface area comprising:

1) a membrane layer containing ionically conductive solid and an ionomeric binder;

2) at least one protective layer disposed adjacent to the membrane layer comprising an ionomeric binder and an ionically conductive solid, and optionally a hygroscopic fine powder;

b) spraying a mixture of oxidizing catalyst, ionomeric binder and ionically conductive solid in a solvent on said first major surface area;

c) spraying a mixture of reducing catalyst, ionomeric binder and ionically conductive solid in a solvent on said second major surface area.

36. The process of claim 35 wherein the membrane layer of step (a)(1) comprises a porous polymeric matrix.

37. The process of Claim 35 wherein the composite membrane of step a) is heat treated from at least about 10 to about 20 minutes at a temperature above 100°C prior to steps b) and c).

38. The process of Claim 35 wherein the composite membrane of step a) is heat treated from at least about 10 to about 20 minutes at a temperature above about 120°C prior to steps b) and c).

39. The process of Claim 35 wherein the spraying employs a carrier gas.

40. The process of Claim 39 wherein the carrier gas is selected from the group consisting of: nitrogen, helium, argon, and carbon dioxide

41. A process for fabricating a membrane electrode assembly (MEA) comprising:

a) obtaining a composite membrane having a first major surface area and a second major surface area comprising:

1) a membrane layer containing ionically conductive solid and an ionomeric binder;

2) at least one protective layer disposed adjacent to the membrane layer comprising an ionomeric binder and an ionically conductive solid, and optionally a hygroscopic fine powder;

b) applying a mixture of oxidizing catalyst, ionomeric binder and ionically conductive solid in a solvent on said first major surface area;

c) applying a mixture of reducing catalyst, ionomeric binder and ionically conductive solid in a solvent on said second major surface area.

42. The process of claim 41 wherein the membrane layer of step (a)(1) comprises a porous polymeric matrix.

43. The process of Claim 41 wherein the composite membrane of step a) is heat treated from at least about 10 to about 20 minutes at a temperature above 100°C prior to steps b) and c).

44. The process of Claim 41 wherein the composite membrane of step a) is heat treated from at least about 10 to about 20 minutes at a temperature above about 120°C prior to steps b) and c).

45. The process of Claim 41 wherein the application of the mixture of oxidizing catalyst is performed by coating, transferring screen printing, brushing, curtain coating, or drip coating.

46. The process of Claim 41 wherein the application of the mixture of reducing catalyst is performed by coating, transferring screen printing, brushing, curtain coating, or drip coating.

47. A process of fabricating a membrane electrode assembly (MEA) comprising:

a). obtaining a membrane having a first major surface area and a second major surface area;

b) applying a solvent comprising an oxidizing catalyst, inomeric binder, and ionically conductive solid in a solvent of said first major surface area;

c) applying a mixture of reducing catalyst, ionomeric binder, and ionically conductive solid on said second major surface area.

48. The process of claim 47 wherein the membrane obtained in step (a) further comprises a polymeric matrix.

49. The method of Claim 47 wherein the application of the mixture of oxidizing catalyst is performed by coating, transferring, screen printing, brushing, curtain coating or drip coating.

50. The method of Claim 47 wherein the application of the mixture of reducing catalyst is performed by coating, transferring, screen printing, brushing, curtain coating, or drip coating.